

Contaminants in Surf Scoters Wintering in the Strait of Georgia, British Columbia, Canada

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Abstract

Populations of scoters have declined in the Pacific Northwest. These declines have gone largely unexplained and have raised concerns about contaminant exposure as large numbers of surf scoters winter in the Georgia Basin, often in polluted estuarine areas and harbours. Scoters are long-lived birds and feed principally on molluscs, a food chain known to accumulate endocrine-disrupting substances. We examined temporal uptake of contaminants by surf scoters during the winter in the Georgia Basin by collecting birds during the early winter and again in the later winter at contaminated and reference sites. Carcasses underwent complete necropsy, and tissues were collected for histology, biomarkers and contaminant analysis. Hepatic EROD activity was induced in scoters collected from the harbour compared to scoters from the reference site. Over winter, the EROD activity increased significantly in scoters from the harbour whereas levels in scoters from the reference site remained constant. This response may have been induced by exposure to PAHs as a PAH-conjugated metabolite was detected in bile. Levels of chlorinated hydrocarbons and metals (Pb, Hg, Se, Cu, Zn, Cd) in scoters were minimal. Scoters wintering in the harbour had approximately 10-fold more butyltins than scoters from the reference site. Body condition of surf scoters declined significantly over the winter at both reference and contaminated sites. Further work is needed to assess if endocrine-disrupting substance exposure on the wintering grounds is contributing to population declines recorded on breeding grounds.

Extended Abstract

Populations of several species of sea ducks, including surf scoters, appear to be declining along the Pacific Coast (Hodges *et al.* 1996). Scoters are now considered a Species of Continental Conservation Concern (Canadian Wildlife Service *et al.* 1997). These declines have gone largely unexplained and have raised concerns about contaminant exposure as large numbers of surf scoters winter in the Georgia Basin, often in polluted estuarine areas and harbours.

Scoters are long-lived birds and therefore have the capacity to accumulate contaminants (Elliott and Martin 1998; Barjaktarovic *et al.* 2002). They feed principally on molluscs and other benthic organisms such as echinoderms, a food chain known to accumulate endocrine-disrupting substances such as butyltins. Butyltin concentrations in diving ducks from the British Columbia coast, particularly surf scoters from Burrard Inlet, were the highest in North American birds (Kannan *et al.* 1998).

We examined temporal uptake of contaminants by surf scoters during the winter in the Georgia Basin by collecting birds during the early winter (December 1998) and again in the later winter (March 1999) at a contaminated (Howe Sound) and a reference site (Baynes Sound). Scoters were also collected during the late winter from two additional contaminated sites—Burrard Inlet (February 1999 and February 2001) and Esquimalt (March 2000). Carcasses underwent complete necropsy, and tissues were collected for histology, biomarkers and contaminant analysis.

Preliminary analysis of the data (adult males only) revealed some significant differences among sites in some of the chemical, biochemical, physiological and morphometric endpoints. Mean body mass of adult males was variable, with birds from Burrard Inlet (February 2001) being significantly lighter than those from Baynes Sound (March 1999). Scoters at contaminated sites appeared to gain mass over the winter months. However, using a scale for body condition based on visual examination of the amount pectoral muscle mass, as well as intra-abdominal, subcutaneous and mesentery fat by a veterinarian, there was no indication of a positive association with body mass; in fact, body condition was estimated to decline in heavier birds. Scoters collected from Burrard Inlet had larger hearts (mass expressed as percent body mass), particularly in February 1999. There was a positive association between heart mass and butyltin exposure in those birds, however, we suspect it is just a coincidence of those birds having larger hearts, and also by wintering in the Burrard Inlet being exposed to butyltins.

Scoters wintering in harbours had approximately tenfold more butyltins than scoters from the reference site. Butyltin burdens in scoters wintering in Burrard Inlet and Howe Sound decreased since the early 1990s, possibly in response to regulatory controls on the use of the chemical in antifouling paints (Garrett and Shrimpton 1997). Levels of chlorinated hydrocarbons and metals (lead, mercury, selenium, copper, zinc, cadmium) in scoters were low. Hepatic EROD activity

was induced in scoters collected from the harbour compared to scoters from the reference site. Over winter, the EROD activity increased significantly in scoters from the harbour whereas levels in scoters from the reference site remained constant. This response may have been induced by exposure to PAHs as a PAH-conjugated metabolite was detected in bile.

Further analysis of the data is needed, however. At this point, there is no clear indication from this work on sea ducks of a particular chemical or group of chemicals linked to the type of serious health effects that could alone reduce survival or reproduction. However, scoters accumulate a wide variety of toxic contaminants, which require diversion of metabolic resources to sequester or detoxify, and which may contribute significantly to the physiological stresses and burdens of these populations. Further work is needed to assess if exposure on the wintering grounds to endocrine-disrupting substances is contributing to population declines recorded on breeding grounds.

References

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